REMARKS

An excess claim fee is attached hereto to cover the cost of the claims added by this Amendment.

Claims 1-41 are all the claims presently pending in the application. Claims 1, 4 and 13 have been amended to more particularly define the invention. Claims 1, 4, 13 and 40 are independent.

Applicant gratefully acknowledges that claims 6 and 7 would be allowable if rewritten in independent form. This Amendment adds new claims 40 and 41 directed to claims 6 and 7 to place them into condition for allowance. However, Applicant respectfully submits that all of the claims are allowable.

Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. The attached page is captioned "**Version with markings to show changes made.**" These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicant also notes that, notwithstanding any claim amendments herein or later during prosecution, that Applicant's intent is to encompass equivalents of all claim elements.

Claims 1-5, 8-21, 24-28, 30-31 and 34-36 stand rejected under 35 U.S.C. § 103(a) as being obvious over D'Amico et al. (U.S. Pat. 5,127,100) in view of D'Amico et al. (U.S. Pat. 5,159,593) and claims 22-23, 29 and 32-33 stand rejected under 35 U.S.C. §103(a) as being obvious over D'Amico et al. (U.S. Pat. 5,127,100) in view of D'Amico et al. (U.S. Pat. 5,159,593) and further in view of Horiguchi (U.S. Pat. 5,737,329).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention is directed to an automobile communications method and apparatus for an onboard mobile station in a plurality of radio zones which are consecutively arranged along a road.

Regarding independent claims 1, 4 and 13 the invention provides each radio zone with a plurality of predetermined communication frequencies, switches a communication frequency used in each of the radio zones using a time division scheme, controls a communication frequency used in each of the radio zones using a time division scheme such that different time slots are allocated for communications at a same communication frequency in adjoining radio zones, and switches a time slot allocated to the on-board mobile station to continuously communicate with the on-board mobile station over the radio zones.

Further regarding new claims 37 - 39, the plurality of predetermined communication frequencies in each radio zone are generated from a single reference frequency.

Regarding independent claims 1, 4 and 13, conventional communication systems use a Time Division Multiple Access (TDMA) communication protocol in which different time slots are used at the same frequency. These TDMA systems enable a wide frequency range to be used. However, it is necessary to increase transmission power by an amount which corresponds to the increase in noise to obtain a desired carrier to noise ration. Additionally, various distortions deteriorate performance. Further, wide-band devices are needed.

By contrast, the present invention as recited by independent claims 1, 4 and 13 provides a novel system having advantages of both Frequency Division Multiple Access (FDMA) and TDMA systems by arranging a plurality of frequencies in each radio zone and switching these frequencies and time slots. In other words, continuous communication is allowed at the same frequency and the frequency range of each of a plurality of frequencies is substantially equivalent to that of an existing FDMA system.

Additionally, the present invention has a further advantage in that interference between adjoining zones can be avoided. A plurality of frequencies are arranged in each zone and are switched in time division manner to select a communication frequency. In this case, if the same frequency is not selected at the same time between adjoining zones, then time slot positions used in adjoining zones are arbitrarily selected. In other words, it is not necessary to select different time slots between adjoining zones. On the other hand, when a communication frequency is switched, if the same frequency can be selected at the same time between adjoining zones, then different time slots are allocated between adjoining zones.

Regarding new claims 37-39, conventional automobile communications systems have been realized based upon an existing mobile telephone system. One example provides roadside transceivers along a roadside to segment the road into consecutive radio zones. Each odd roadside transceiver is assigned a first operating frequency and each even roadside transceiver is assigned a second operating frequency. Therefore, any onboard mobile station passing through the radio zones is required to switch frequencies as it passes between odd and even radio zones and fast hand-off between each consecutive zone requires fast frequency switching. This burden significantly increases the complexity of the onboard mobile station.

By contrast, the exemplary embodiment of the present invention as recited in new claims 37-39, provides an automobile communications system and method which can ensure fast hand-over without putting unnecessary burdens on mobile stations. This exemplary embodiment permits continuous communication over a plurality of radio zones without switching transmission and reception frequencies. This exemplary embodiment is capable of providing these advantages because each of the plurality of radio zones is provided with a plurality of predetermined communication frequencies AND the communication frequencies of each of the radio zones is used in a time division scheme while different time slots are allocated for communications at a same communication frequency in adjoining radio zones.

Additionally, the exemplary embodiment recited in claims 37-39 is capable of further increasing the speed of hand-offs between radio zones by ensuring that the plurality of communication frequencies in each radio zone are in a state of frequency-coherence. In particular, the plurality of communication frequencies are in frequency-coherence because they are generated from a single reference frequency, see for example, page 4, lines 9-10. Additionally, the use of the same predetermined conversion between the roadside transceivers and the on-board transceiver can set the overall system into a frequency-coherence state, so that the demodulators of the roadside transceiver and the on-board transceiver can achieve extremely rapid synchronization acquisition.

II. THE PRIOR ART REJECTIONS

Regarding claim 1, 4, 13, 15, 25 and 35, the Examiner alleges that U.S. Patent No. 5,127,100 (hereinafter "the '100 patent") would have been combined with U.S. Patent No. 5,

159,593 (hereinafter "the '593 patent") to form the claimed invention. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

First, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to completely different matters. Specifically, the '100 patent is directed to reducing the complexity of an installed infrastructure by providing a roving station which is capable of determining between which cells the roving station should be transferred (col. 1, lines 11-41 and 45-48).

In contrast, the '593 patent is specifically directed to a subscriber transmitting a request for a channel assignment from a base station in accordance with a "set of criteria" (col. 1, lines 44-59). Thus, the references would not have been combined, absent hindsight.

Further, even assuming arguendo that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention.

The '100 patent does not teach or suggest switching a plurality of frequencies arranged in each radio zone as recited by independent claims 1, 4 and 13.

As explained above, the present invention as recited by independent claims 1, 4 and 13 provides a novel system having advantages of both Frequency Division Multiple Access (FDMA) and TDMA systems by arranging a plurality of frequencies in each radio zone and switching these frequencies and time slots. In other words, continuous communication is allowed at the same frequency and the frequency range of each of a plurality of frequencies is substantially equivalent to that of an existing FDMA system.

Additionally, the present invention has a further advantage in that interference between adjoining zones can be avoided. A plurality of frequencies are arranged in each zone and are switched in time division manner to select a communication frequency. In this case, if the same frequency is not selected at the same time between adjoining zones, then time slot positions used in adjoining zones are arbitrarily selected. In other words, it is not necessary to select different time slots between adjoining zones. On the other hand, when a communication frequency is switched, if the same frequency can be selected at the same time between adjoining zones, then different time slots are allocated between adjoining zones.

Contrary to the Examiner's allegation, the '100 patent does not disclose switching a plurality of frequencies arranged in each radio zone as recited by independent claims 1, 4 and 13.

Regarding new claims 37-39, the '100 patent discloses a digital radio communication system and a two-way radio. As explained above, the '100 patent is concerned with reducing the complexity of an installed infrastructure by providing a roving station which is capable of determining between which cells the roving station should be transferred (col. 1, lines 11-41 and 45-48). The '100 patent explains that "[T]ypically adjacent cells operate on different frequencies to avoid interference." (col. 1, lines 18-19). The '100 patent explains that while each cell may have its own unique frequency to avoid interference, that each cell may operate in accordance with a time division multiple access system (TDMA) to prevent interference between roving radios operating within each individual cell (col. 2, lines 55 - 65).

The '100 patent explains that two different methods may be used to prevent interference between cells and that both of these methods may be used simultaneously. In particular, the '100

patent explains that different frequencies may be used for the individual cells in an FDMA scheme and that the same frequency may be used by adjacent or remote cells provided that the cells do not use the same time slots (as in a TDMA scheme) (col. 3, lines 22-43).

However, contrary to the Examiner's allegations, the '100 patent does not teach or suggest the plurality of predetermined communication frequencies in each radio zone being generated from a single reference frequency. Rather, col. 6 lines 19-28 of the '100 patent, which is cited by the Examiner at page 3 of the Office Action, states: "A two-way digital radio for use in a communication system having adjacent cells to the cell the digital radio is currently operating in, the cells having base stations, the base station of the cell the digital radio is currently operating in transmits data to and receives data from the digital radio, the adjacent cells base stations operate using different transmit and receive frequencies, different data transmission rates, and/or transmit data to the digital radio during different communication time slots." There is absolutely no mention in this or any other portion of the '100 patent of a plurality of predetermined communication frequencies in each radio zone being generated from a single reference frequency.

Moreover, regarding claims 1, 4 and 13, the '593 patent, like the '100 patent does not teach or suggest switching a plurality of frequencies arranged in each radio zone as recited by independent claims 1, 4 and 13.

As explained above, the present invention as recited by independent claims 1, 4 and 13 provides a novel system having advantages of both Frequency Division Multiple Access (FDMA) and TDMA systems by arranging a plurality of frequencies in each radio zone and

switching these frequencies and time slots. In other words, continuous communication is allowed at the same frequency and the frequency range of each of a plurality of frequencies is substantially equivalent to that of an existing FDMA system.

Additionally, the present invention has a further advantage in that interference between adjoining zones can be avoided. A plurality of frequencies are arranged in each zone and are switched in time division manner to select a communication frequency. In this case, if the same frequency is not selected at the same time between adjoining zones, then time slot positions used in adjoining zones are arbitrarily selected. In other words, it is not necessary to select different time slots between adjoining zones. On the other hand, when a communication frequency is switched, if the same frequency can be selected at the same time between adjoining zones, then different time slots are allocated between adjoining zones.

Thus, the '593 patent does not disclose switching a plurality of frequencies arranged in each radio zone as recited by independent claims 1, 4 and 13.

Regarding claims 37-39, the '593 patent, like the '100 patent, does not teach or suggest "a plurality of predetermined communication frequencies in each radio zone being generated from a single reference frequency".

Rather, as explained above, the '593 patent discloses a channel acquisition and handoff method and apparatus for a TDMA communication system. In particular, the '593 patent discloses a subscriber transmitting a request for a channel assignment from a base station in accordance with a "set of criteria" (col. 1, lines 44-59). The entire disclosure of the '593 patent is directed to an explanation of how the subscriber and the base station determine when to hand-

off to another cell and how that hand-off is accomplished. There is no disclosure at all about how many frequencies may be used by the system, or even how a communication frequency is generated, let alone a plurality of predetermined communication frequencies in each radio zone being generated from a single reference frequency.

The Examiner alleges that the Horiguchi reference would have been combined with the '100 patent and the '593 patent to form the claimed invention. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to different matters. Specifically, as explained above, the '100 patent is directed to reducing the complexity of an installed infrastructure by providing a roving station which is capable of determining between which cells the roving station should be transferred (col. 1, lines 11-41 and 45-48) using a Time Division Multiple Access (TDMA) system (col. 2, lines 63-65) or a Frequency Division Multiple Access (FDMA) system or a combination of TDMA and FDMA (col. 3, lines 22-48). The '593 patent is specifically directed to a subscriber transmitting a request for a channel assignment from a base station in accordance with a "set of criteria" (col. 1, lines 44-59) for a TDMA system (col. 1, lines 44-46).

In contrast, the Horiguchi reference is specifically directed to a spread spectrum (CDMA) communication apparatus which is able to perform multiple communications without requiring an increase in the scale of pseudo noise code generators (col. 2, lines 16-20).

While a TDMA system and an FDMA system may be compatible with each other in that a receiver can completely separate the signals arriving on different physical channels, a CDMA

system is not at all compatible with either of a TDMA or FDMA system, since the output of a receiver contains small components of all the input signals in a CDMA system. Therefore, since CDMA systems are fundamentally different from TDMA and FDMA systems, one of ordinary skill in the art would not have been motivated to combine the teachings of the Horiguchi reference with either of the '100 patent or the '593 patent.

Additionally, as explained above, the CDMA system disclosed in the Horiguchi reference is fundamentally different from the claimed invention. Contrary to the Examiner's assertion, the demodulator disclosed in the Horiguchi reference would not be operable in either of the systems disclosed in the '100 patent or the '593 patent. The demodulator disclosed in the Horiguchi reference at col. 2, lines 28-31 demodulates the reverse spread spectrum received signal. By contrast, the systems disclosed in the '100 and '593 patents do not operate based upon a spread spectrum.

Even assuming arguendo, that one of ordinary skill in the art would have been motivated to combine these references, even if combined, the combination would not teach or suggest each and every element of the claimed invention.

The Horiguchi reference does not remedy the deficiencies of the '100 patent and the '593.

Regarding claims 1, 4 and 13, the Horiguchi reference does not teach or suggest switching a plurality of frequencies arranged in each radio zone.

Regarding claims 37-39, the Horiguchi reference does not teach or suggest a plurality of predetermined communication frequencies in each radio zone being generated from a single reference frequency.

The Examiner is respectfully requested to withdraw these rejections.

III. FORMAL MATTERS AND CONCLUSION

Applicant notes that the Examiner has yet to acknowledge receipt of the priority document that was submitted on August 26, 1999. Applicant respectfully requests that the Examiner acknowledge receipt of the priority document in the next paper.

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1-41, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 1/14/03

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims 1, 4 and 13 as follows:

1. (Amended) An automobile communications method for an on-board mobile station in a plurality of radio zones which are consecutively arranged along a road, comprising [the steps of]:

providing each of the radio zones with a plurality of predetermined communication frequencies;

switching a communication frequency used in each of the radio zones using a time division scheme;

controlling a communication frequency used in each of the radio zones [in] using a time division scheme such that [simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones and] different time slots are allocated for communications at a same communication frequency in adjoining radio zones; and

switching a time slot allocated to the on-board mobile station to continuously communicate with the on-board mobile station over the radio zones.

4. (Amended) An automobile communications method between an on-board mobile station and a fixed station system in a plurality of radio zones which are consecutively arranged along a road, comprising [the steps of]:

providing each of the radio zones with a plurality of predetermined communication frequencies;

switching a communication frequency used in each of the radio zones using a time division scheme;

controlling a communication frequency used in each of the radio zones [in] using a time division scheme such that [simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones and] different time slots are allocated for communications at a same communication frequency in adjoining radio zones; and

continuously communicating with the on-board mobile station at a same communication frequency over the radio zones.

13. (Amended) An automobile communications system comprising:

an on-board mobile station movable on a road;

a plurality of fixed stations forming a plurality of radio zones consecutively arranged on the road, respectively, wherein the fixed stations are communicable with the on-board mobile station using one of a plurality of predetermined communication frequencies; and

a control station controlling communication frequencies used by the plurality of fixed stations at a predetermined timing in such a way as not to permit simultaneous transmission at a same communication frequency in adjoining radio zones,

the plurality of fixed stations performing continuous communication with the on-board mobile station by allocating different time slots to communications at a same frequency in adjoining radio zones and switching a time slot allocated to the on-board mobile station and by switching a communication frequency used in each of the radio zones using a time division scheme.

Please add new claims 37 - 41 as follows:

- - 37. (Newly Added) The method of claim 1, wherein the plurality of predetermined communication frequencies in each radio zone are generated from a single reference frequency. - -

- - 38. (Newly Added) The method of claim 4, wherein the plurality of predetermined communication frequencies in each radio zone are generated from a single reference frequency. - -

- - 39. (Newly Added) The system of claim 13, wherein the plurality of predetermined communication frequencies in each radio zone are generated from a single reference frequency. - -

- - 40. (Newly Added) An automobile communications method between an on-board mobile station and a fixed station system in a plurality of radio zones which are consecutively arranged along a road, comprising:

providing each of the radio zones with a plurality of predetermined communication frequencies;

controlling a communication frequency used in each of the radio zones using a time division scheme such that simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones and different time slots are allocated for communications at a same communication frequency in adjoining radio zones; and

continuously communicating with the on-board mobile station at a same communication frequency over the radio zones,

wherein a predetermined number N (N is an integer equal to or greater than 2) of time slots are determined in one period in each of the radio zones, wherein one time slot is assigned to a single on-board mobile station and M (M is an integer equal to or greater than 2) predetermined communication frequencies are sequentially switched from one to another at a timing of every N/M time slot.- -

- - 41. (Newly Added) The automobile communication method according to claim 40, wherein the time slot allocated to the on-board mobile station is switched in such a way that the on-board mobile station uses a same communication frequency over the plurality of radio zones.- -